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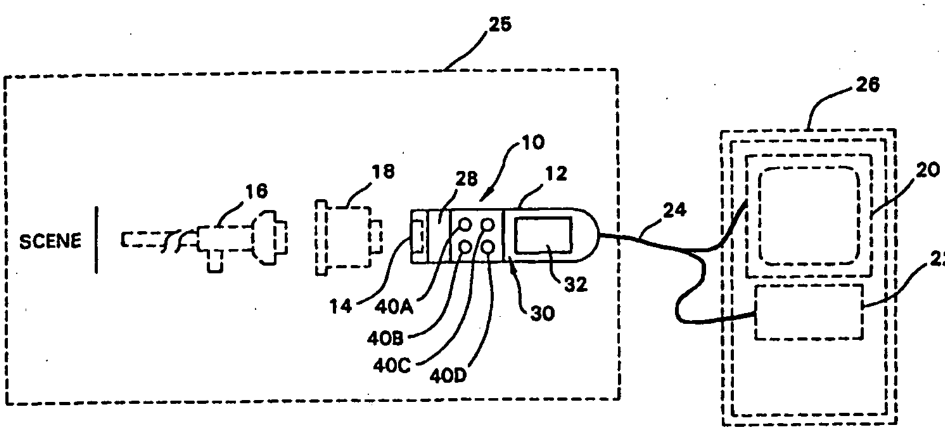

(57) Abstract

The invention provides a videocamera (10) particularly well suited for use with endoscopes. The video camera (10) includes a camera housing (12) for removable attachement to a scope (16). Mounted inside the camera housing (12) is an image pickup device (28) to receive optical input from the endoscope (16) and create electrical signals based on the optical input. These signals are communicated to a camera signal unit (30) which is also mounted in said camera housing (12). The camera signal unit (30) converts the signals into a display monitor signal for output to a monitor (20). At least one camera function control button (401-d) is mounted to said camera housing (12) and electrically connected to said camera signal unit (30) to control internal or external functions.

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HAND HELD SCOPE VIDEO SYSTEM WITH INTERNAL VIDEO PROCESSOR

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to scopes in general such as may be used to view inside a cavity with limited access. More particularly, the present invention relates to endoscopes such as are commonly used in human surgery and even more particularly to a hand held endoscope video system having a video processor built into the endoscope's handpiece.

Description of the Prior Art

Endoscopic imaging systems are commonly used for internal viewing of organs and tissues in living organisms such as the human body. For years Doctors have been using endoscopes on humans to provide access to parts of the human body with reduced trauma. For example, Orthopedic surgeons use endoscopic procedures to access joint cavities, and OB/GYN surgeons have been using endoscopes to treat various problems in the pelvic area for years. While endoscopes are often used for surgery and diagnosis in medicine, they are also be used in veterinary medicine, in scientific research and the like.

Although there are many designs of endoscopes, they fall into two main categories: flexible and rigid. A rigid endoscope generally includes an objective lens, a rigid cylinder shaped rod-lens system and an eye piece or camera head. A flexible endoscope has a similar configuration except instead of a rod-lens system a fiber optics are is

used to allow the endoscope to maneuver around obstacles. Commonly the flexible endoscope are equipped with deflecting tips which can be used to direct or point the distal end of the endoscope, and fiber optic bundles are used inside this flexible scope assembly to transmit optical information from the distal end of the scope up to the eyepiece or camera head. Similarly fiber optics may be used to transmit light down and out of the distal end of the scope to illuminate the area to be viewed.

At one time the scope images were viewed directly by the user or surgeon through a scope eye piece. Today small TV cameras are used with the scope to display the image on a monitor screen instead of directly viewing by eye. In fact, many medical text books teach that a camera system is essential in performing effective diagnostic and therapeutic procedures.

In General, current TV systems for endoscopy have camera head, a cable leading from the camera head to a camera control unit and a video display connected to the camera control unit. The camera control unit ("CCU") is a large box which sits on a mobile cart along with the viewing screen and other large components such as a light source, video cassette recorder (VCR), still camera and the like. The camera head is attached to the endoscope and contains an image pickup device such as a CMOS or CCD imager. The pickup device acquires and sends image information through a multiconductor electrical cable to an image processor in the CCU. Once signal information is at the CCU, the CMOS or CCD image signals are processed to produce high quality NTSC or PAL TV signals

The cable connecting the camera head to the CCU is composed of several single conductors and coaxial cables to deliver the required drive signals and voltages to the imaging device and return the image signal back to the camera control unit for processing. Since current systems have the camera head several feet from the CCU, a number of problems occur. Some of the problems are, synchronization of signals, power drop and the size, weight and flexibility the cable needed to carry the necessary conductors. In the past the individual wires in the cable have been kept small to keep the over all cable size small and flexible. However, the small size of the conductors contained in the cable lead to additional problems. Cable failure can occur frequently with this number of small wires being continuously flexed during surgical use and the cable can also act as an antenna and can pick up other interfering signals that can contaminate the low level signals used with the imaging device. The interfering signals are especially problematic in surgery where an endoscope is commonly used near other electrical devices, such as an electro carteri unit. In addition, as the conductors get smaller voltage drop becomes more problematic.

The current invention is a camera system that combines an image pickup device and a camera control unit "CCU" into a single unit. It is important to note that in prior art systems a CCU was a remote unit, in relation to this invention the CCU will be called a camera signal processing unit it is local, i.e. in the same housing as the image pickup device. By making this combination the disadvantages listed above are either eliminated or significantly reduced. In addition this invention produces many advantages over current camera systems including a reduction of the cost of the camera system and increased camera

performance. These advantages are generally due to the image and processing circuitry being located together. Improved immunity to electrical interference and improved reliability are generally due to the significant reduction of both the single conductor and coaxial wires needed between the endoscope and the viewing screen. In addition, operation is simplified due to the image pickup device being consolidated with the image processor and controls.

A further advantage of the video system of this invention is that miniature buttons are located on the camera case to provide a means to operate internal camera functions like: white set, enhancement, gain control, shutter control, light sensitivity, and the like; as well as external device functions such as: record, image capture, image save, print and etc. This means the operator or surgeon has access to these controls at their finger tips. In prior art systems such controls were either located remotely such as on the CCU located on a surgical cart remote from the camera head or they required even more conductors in the cable to carry signals to the remote CCU. This generally meant that some other person in the operating room had to activate the controls when directed to by the surgeon.

Yet another advantage of the video system of this invention is that it is much easer and less expensive to meet the current international standard IEC 601-1 requiring BF isolation. In general BF isolation requires that there be no direct electrical conductive path for current to pass to the endoscope from the outside. With prior art systems this meant that nine to sixteen conductors each had to have some means of isolation such as individual transformers, optical couplings or isolated DC to DC power. In contrast, the current

invention has significantly fewer conductors leading to the endoscope and therefore fewer isolation means are required. In fact, if only internal camera function buttons are provided (such as white set and the like), only a single video isolation circuit along with a medical grade power supply will meet the requirements. Even if external camera function buttons are provided the number of isolating devices are significant less than are required on current endoscopes.

SUMMARY OF THE INVENTION

In view of the foregoing disadvantages inherent in the known types of endoscopes now present in the prior art, the present invention provides improved scope construction wherein the same can be utilized reliably in those situations where dependability, safety and improved camera performance are desired. As such, the general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new and improved scope camera system which has all the advantages of the prior art devices and none of the disadvantages.

To attain this, the present invention essentially comprises a scope video camera for connection to scope such as an endoscope. The camera has a camera housing for attachment to an endoscope with an optical receptor mounted in the camera housing to receive optical input from the endoscope. A video processor is also mounted in the camera housing and is electrically connected to the optical receptor. In addition, camera function control buttons are mounted to the camera housing to operate functions such as white set, gain control, shutter

control, enhancement, light sensitivity, image capture, record, image save, image print, and the like.

There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject matter of the claims appended hereto.

In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in this application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting. As such, those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

Further, the purpose of the foregoing abstract is to enable the U.S. Patent and Trademark Office and the public generally, and especially the scientist, engineers and practitioners in the art who are not familiar with patent or legal terms or phraseology, to determine

quickly from a cursory inspection the nature and essence of the technical disclosure of the application. The abstract is neither intended to define the invention of the application, which is measured by the claims, nor is it intended to be limiting as to the scope of the invention in any way.

It is therefore an object of the present invention to provide a new and improved endoscope video camera which may be easily and efficiently manufactured and marketed.

It is a further object of the present invention to provide a new and improved endoscope video camera which is of a durable and reliable construction.

An even further object of the present invention is to provide a new and improved endoscope video camera which is susceptible to a low cost of manufacture with regard to both materials and labor, and which accordingly is then susceptible to low prices of sale to the consuming public, thereby making such camera economically available to the buying public.

Still another object of the present invention is to provide a new and improved endoscope video camera which provides all of the advantages of the prior art, while simultaneously overcoming some of the disadvantages normally associated therewith.

Another object of the present invention is to provide a new and improved endoscope video camera having increased camera performance.

Yet another object of the present invention is to provide an endoscope video camera with improved immunity to electrical interference.

An even further object of the present invention is to provide and endoscope video camera with simplified operation.

These together with other objects of the invention, along with the various features of novelty which characterize the invention, are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic view of a hand held scope video camera constructed in accordance with the present invention connected to an endoscope and a display monitor.

FIG. 2 is an enlarged schematic view of the hand held scope video camera of FIG.1 showing the preferred component parts.

FIG. 3 is a schematic view of the hand held scope video camera constructed in accordance with the present invention and having a local light source.

FIG. 4 is a schematic view of the hand held scope video camera constructed in accordance with the present invention and having a local light source.

FIG. 5 is a front view of the preferred camera case of the hand held scope video camera of FIGS. 1-3.

FIG. 6 is a rear view of the preferred camera case of the hand held scope video camera of FIGS. 1-3.

FIG. 7 is a rear view of the preferred camera case of the hand held scope video camera of FIGS. 1-3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in detail and to FIG. 1 in particular, reference character 10 generally designates a hand held scope video camera constructed in accordance with the present invention. The camera 10 includes a camera housing 12 with a mount coupling 14. Preferably the mount coupling is a "C-Mount" coupling which is the industry standard for attachment of video systems to endoscopes, but it could be some other type of mount such as a standard "V-Mount" or even proprietary threads. In this way, the camera 10 can be attached to an endoscope 16 with standard coupler such as coupler 18.

The camera 10 is removably connected to a video monitor 20 and a power supply 22 by a cable 24. The video monitor is preferably a high resolution monitor and is used to display the images collected by the camera. Similarly the camera 12 is connected to the power supply 22 to provide the energy to operate the camera 12. Of course, the power supply 22 could be incorporated into the video monitor 20, but such is not necessary, nor is it desired since many suitable monitors and power supplies are readily available and are well known to those in the art.

It is important to note, that with the current invention the cable 24 is significantly lighter, less expensive, more durable and less susceptible to interference from nearby electrical systems than those

used in the past. As will be explained in greater detail below. In general this is because with the camera 10 as few as four conductors are contained in the cable 24, which reduces the complexity of the line and the connectors which make up the cable 24 as well as any receptacles used with the cable. In contrast, prior art endoscopic video systems required a cable with many more conductors (usually from 9 to 16) to extend from the endoscope to a remote video processor. The cables, connectors, and receptacles currently used generally cost several times more than those for the current invention and weigh significantly more. The cable 24 is more durable simply because there are fewer conductors to damage and since fewer lines are used they may be made larger and still provide a smaller and more flexible overall cable. The cable 24 is less susceptible to interference from nearby electrical systems than those used in the past because with the current invention the cable can carry a standard 75 ohm, 1 volt video signal which has a great immunity compared to the signals carried back and forth through endoscopic cables between camera heads and camera control units.

Often endoscopes are used in a sterile environment such as when performing surgery on a human. In such a case, the camera housing 12 may be inside a "sterile field" when it is used and in that case, the cable 24 will extend outside the sterile field to a surgical cart 26 which holds the monitor 20 and other equipment (the sterile field is indicated by dashed line 25). Since the camera housing 12 and portions of the cable 24 may be used in the sterile field they must withstand sterilization. Therefore, the camera housing 12 must be able to withstand sterilization and protect the components inside the housing. In addition

the cable must also be sterilized without damaging connection points between the cable's conductors and the electronics in the camera. This is preferably accomplished by connecting the cable 24 to the electronic components inside the housing 10, and then sealing the camera housing sufficiently to withstand cold soak sterilization or gas sterilization. The opposite end of the cable may have its cable connector end capped. Since the cable 24 has needs significantly fewer conductors to operate the video camera connectors may be larger and thus less susceptible to damage from use or serialization.

The camera housing 12 should be small enough to allow easy manipulation by the operator. In the preferred embodiment the housing is sized and shaped to allow the operator to hold the endoscope by the camera housing and reach camera control buttons which are discussed in detail below.

An image pickup device 28 is mounted in the camera housing 12 to receive optical input from the endoscope when attached thereto. Preferably the image pickup device is a CCD (Charged-Coupled Device) having a resolution of at least 410 TV lines, more preferably at least 480 TV lines and a minimum light requirement of 2 Lux. While single chip mosaic filter CCDs are more common in these types of cameras, certainly a single chip RGB filter type device, CMOS device or a CMOS with similar filters could be used. Performance values comparable to that of three chip cameras could be obtained with using RGB filter type imagers. The video processor could then provide NTSC or PAL video signal in either composite, Y-C, or digital format.

Also inside the camera housing is mounted a camera signal processing unit 30. The camera signal processing unit 30 is electrically

connected to the image pickup device 28 by a plurality of electrical conduits and includes an image processor with circuitry and camera function circuits. The image processor and circuitry receive electrical signals from the image pickup device and convert the signals into a display monitor signal such as NTSC or the other signal which may be viewed on a cathode ray tube (e.g. television, computer monitor, high resolution monitor or the like). The camera function circuits allow the user to access functions such as white set, different levels of enhancement, image capture, image save and the like. It should be noted that where camera functions such as image capture and image save are used means for storage are required and an external device should be provided for such storage. One or more conductors in cable 24 should also be provided to communicate the function to the remote device. However, circuits for desired local functions such as white set, enhancement, sensitivity, light measurement selection, and the like should be integrated into the camera housing to minimize the number of conductors needed in cable 24.

Since the video processor and the image pickup device are located near each other, as opposed to several feet away in prior art systems, problems with synchronization, voltage drop and the like are significantly reduced. In addition, the connections between the image pickup device and the camera signal unit are plentiful, generally ranging from nine to sixteen conductors. Therefore, the proximity of the video processor to the image pickup device can reduce the number of conductors needed in a cable (like cable 24) down from the nine or more previously required to about four. That is, with the current

invention a single pair of conductors may be used to carry the TV signal and a single pair of conductors may be used to provide power.

Referring now to FIG. 2, shown therein is an enlarged schematic view of the hand held video camera of the current invention showing the preferred component parts. The camera housing 10 is preferably made from two halves that seal against each other with a seal such as an elastomeric gasket, o-ring or the like. Another seal 34 should be provided to accommodate the cable 24 and is preferably at the posterior of the camera housing. The seals are to prevent the invasion of any gas, moisture or the like which might hinder the function of the camera. By way of example, and not limitation, the seals should hinder gas or liquid penetration, from present liquid or gas disinfection or sterilizations processes used in the medical and/or veterinary industry or liquid gas, or particles found in industrial, manufacturing, service, or other similar environments that might hinder the function of the camera.

On the anterior portion of the camera housing 10 is a mount coupling 14. The mount coupling 14 is provided so the housing 10 may be connected to a scope 16 such as is shown in FIG. 1. Preferably the mount coupling 14 is a camera industry standard "C-Mount," or "V-Mount," but so long as it provides means for attaching the housing 10 to the scope any suitable mount will do, even a proprietary thread mount.

A transparent window 36 sealed against the invasion of gas, moisture and the like is also located near the anterior of the housing 10 to allow optical information from the scope to enter the housing. The window 36 is preferably made from glass or an optical plastic to minimize any distortion of the optical information passing there through.

An image pickup device 28, such as a CCD or CMOS, is positioned anterior to the window 36 for receiving optical input from the scope and creating electrical signals based on the optical input. The CCD or CMOS is connected to a camera signal unit 30 which has a video processor 32 and a button/switch interface 38. The video processor 32 receives the electrical signals from the CCD or CMOS, and converts the signals into a display monitor signal such as NTSC or PAL. The button/switch interface 38 has a printed circuit board designed to act as a connection buss and as a logic function device in controlling internal or external system functions, and is electrically connected to function control buttons (such as buttons (e.g. 40A, 40B, 40C and 40D) by connections such as lines 42. The lines 42 from the buttons designated for external functions preferably bypass the video processor, whereas lines 42 from buttons designated for internal camera functions would interface with the video processor. The button/switch interface is also electrically connected or incorporated into the video processor 32 such as by cable bundle 44. It should also be noted that cable bundle 44 may also include cable connectors 46 and 48 for connection to the video processor 32 and the pickup device 28 respectively, since the cable bundle 44 also includes the many conductors needed between the image pickup device 28 and the processor 32. This button/switch interface 38 may utilize existing circuits in the video processor or may be a separate set of circuits as is shown in FIG.2.

The buttons 40A, 40B, 40C and 40D and the associated circuitry may be designated for any of the internal or external functions such as listed above. By way of example, and not limitation, button 40A may be assigned as a power on/off toggle. In which case the associated

circuitry would interrupt power to the system in one position and connect power to the system in the other. In a similar fashion each of the remaining buttons 40B, 40C and 40D could also be assigned either an internal function or an external function.

Cable 24 is connected to the video processor 32 by a cable connector 50, and extends through the housing 10. Of course, the electrical connections made through the various connectors discussed could be direct, i.e. fused, soldered or the like, but connectors are preferred for compatibility with available parts, ease of assembly, and repair. As discussed above, the cable 24 may include as few as four conductors, a pair for transferring the video signal to a monitor and a pair to supply power to the invention. Of course additional conductors may be added to provide separate lines of communication to external devices. In the most preferred embodiment, the cable 24 is a five conductor cable having three individual solid copper conductors, and one individual 75 ohm impedance coaxial conductor. In this way, the coaxial conductor can carry the video signal (which is less susceptible to interference than the signals carried by current cables between the camera head and the processor), and the three individual conductors may be used to provide power to the invention and carry signals to external devices (a power, a ground, and a signal line). These five conductors are preferably surrounded by a plastic insulating dielectric which is in turn surrounded by a braided silver plated copper shield. The shield preferably covers greater than 90% of the dielectric, and the entire bundle is then preferably covered with an elastomeric jacket.

FIG. 3 shows the hand held scope video camera having a local light source. Since many similar components are used in the following

figures as were used in the preceding figures, the same reference numbers are maintained for these components, and new reference numbers are used for new components.

Often when using a scope it is to see into an unlit cavity, such as inside a human body. Because of this, the scope must not only be able to capture optical information, but also provide the illumination for the area to be viewed. To accomplish this scopes, such as endoscope 16 generally include a fiber optic bundle which extends from a light post 52 to the distal end of the endoscope. A remote light source is provided, and light from the light source is transferred to the light post by another fiber optic bundle which attaches to the light post. In the invention as shown in FIG. 3, a local light source is provide thereby eliminating the need for a fiber bundle to extend from the endoscope to a remote light source, and thus making the scope much easier to use.

To accomplish this a light source having 54 a electric lamp 60 mounted in a housing 55 is provided. The housing has an adaptor 58 for attachment to the light post 52 so that the lamp will emit light into the lamp post when illuminated. Preferably the adaptor for attachment to the light post is sized and shaped for the standard endoscopic light post so it may be used with a variety of existing endoscopes. Window 78 is provided to seal the housing to prevent the invasion of any gas or moisture that might hinder or damage the light source curing cleaning, disinfecting or sterilizing.

A power cable 56 is provided to supply power to the lamp 60. The cable may receive its power from either a battery, such as battery 66 (shown in FIG. 4) contained in the camera housing 10, or more preferably from an external source via conductors in cable 24.

The embodiment of FIG.4, totally eliminates the need for cable 24 thereby further enhancing the ease of use. To accomplish this the camera housing 10 contains: a radio frequency transmitter 62, an antenna 64, and a battery 68. In the current invention, the video processor 32 is located in the housing 10 and therefore, as discussed above, a single video signal may be produced and transmitted to a receiver 68 which may be displayed on the monitor 20. In prior art systems where the processor was remote this was not practical since a large number of specifically timed signals had to be communicated between the pickup device and the processor. Since the current invention has a local video processor a single video signal may be transmitted.

In the preferred embodiment, a frequency transmitter 62 is connected to the video processor output by conductor 71. The transmitter converts the video signal and transmits it as a RF frequency 70 to the receiver 68 which decodes it into standard NTSC or PAL for video display on monitor 20. The transmitter 62 as well as the other electrical components (e.g. video processor and CCD) are powered by a battery 66. An antenna connected to the transmitter is provided to transmit a RF signal. The transmitter and its antenna my transmit in any suitable band or frequency which will carry the signal to the receiver. By way of example and not of limitation, the transmitter may transmit the image in an 900 megahertz frequency.

Figures 5-7 show, in general, one preferred shape and size of the camera housing of FIGS. 1-3. As discussed above an important part of this invention is to provide a hand or palm held scope video camera which is easy to use. To accomplish this the maximum size and weight of the

of housing and its internal components must be limited. By utilizing components which may be purchased from commercial suppliers such as SENTECH the size of the housing shown in FIGS. 5 through 7 may be attained. In particular the STC-630 digital camera components currently sold by SENTECH may be used to meet most of the component requirements disclosed herein. It should be noted however, that current commercial components do require software setting to accomplish all of the functions disclosed in this description but, after having read this specification, those of ordinary skill in the art of camera production will be able to incorporate the appropriate functionality. One of ordinary skill in the art could also incorporate hardware circuits without undue experimentation which will provide the functionality described above, for example the STC-630 should have white set and enhancement pin connectors added and should not have a lenz mounting.

Figure 5 shows one of the preferred configurations of front of the scope of the current invention. The housing 10 has a generally square front profile with the front width 72 and front height 74 each being less than 3.5 inches, more preferably of less than 2.5 inches, and most preferably width 72 and height 74 are each about 2.21 inches.

Figure 6 shows the front side of the embodiment of FIG. 5 along with the preferred layout and relative size of the function buttons 40A, 40B, 40C, and 40D. Figure 7 is a side view of the embodiment of FIG. 5 showing its general size and shape perportions. Preferably the over all depth 76 is less than 3.5 inches, more preferably less than 2.5 inches, and most preferably about 2.22 inches. Depth 78 is preferably less than 1.5 inches and more preferably less than 1.25 inches and most preferably about .93 inches. The overall weight of the camera case 10 and its

internal components is preferably less than 16 ounces, and more preferably less then 13.8 ounces.

Changes may be made in the combinations, operations and arrangements of the various parts and elements described herein without departing from the spirit and scope of the invention as defined in the following claims.

Claims

I claim:

1. A hand held endoscope video camera for connection to an endoscope comprising:

a camera housing for removable attachment to a endoscope;

an image pickup device mounted in said camera housing to receive optical input from the endoscope and creating electrical signals based on the optical input;

a camera signal unit mounted in said camera housing and electrically connected to said image pickup for receiving the electrical signals from the image pickup device and providing a signal suitable for driving a display monitor; and

at least one function control button mounted to said camera housing and electrically connected to said camera signal unit.

2. The hand held endoscope video camera of claim 1 wherein said camera signal unit comprises a video processor, and at least one function control circuit, said video processor being connected to said function control circuit.

3. The hand held endoscope video camera of claim 1 wherein said camera signal unit comprises a video processor, and a white set function control circuit, said video processor being connected to said white set function control circuit to set the white balance of a video signal out put from the video camera.

4. The hand held endoscope video camera of claim 1 comprising at least two function control circuits, at least on said function control circuit for

accessing an internal camera function and at least one said function control circuit for accessing an external control.

5. The hand held endoscope video camera of claim 1 further comprising a cable having first and second ends, said first end connected to said endoscope video camera and said second end adapted for removable connection to a display monitor for transmitting video signals from said endoscope video camera to the display monitor, and wherein said cable includes less than eight conductors.

6. The hand held endoscope video camera of claim 5 wherein said cable includes less than 5 conductors.

7. The hand held endoscope video camera of claim 5 wherein said cable comprises at least one coaxial cable for carrying the display monitor signal from the camera signal unit.

8. The hand held endoscope video camera of claim 1 wherein the image pickup device produces at least 410 lines of resolution.

9. The hand held endoscope video camera of claim 8 wherein the image pickup device produces at least 480 lines of resolution.

10. The hand held endoscope video camera of claim 8 wherein the camera housing has a height of less than 3.5 inches and a depth of less than 3.5 inches.

11. The hand held endoscope video camera of claim 8 wherein the camera housing has a height of less than 2.5 inches and a depth of less than 2.5 inches.

12. The hand held endoscope video camera of claim 1 further comprising:

A transmitter for converting the display monitor signal into a frequency for transmission through space to a remote receiver;

An antenna connected to the transmitter for transmission of the frequency; and

A battery to supply power to the endoscope video camera.

13. The hand held endoscope video camera of claim 1 wherein said camera housing is sealed against the invasion of gas or liquid from gas or submersion disinfection or sterilization processes used in the medical industry that might hinder the function of the camera.

14. The hand held endoscope video camera of claim 1 further comprising a local illumination source containing a light for connection to a endoscope, wherein said light receives power from a cable extending from said video camera to an external power source.

15. The hand held endoscope video camera of claim 1 further comprising a local illumination source containing a light for connection to a endoscope, wherein said light receives power from a battery.

16. A hand held endoscope video camera for connection to an endoscope comprising:

A camera housing for removable attachment to an endoscope;

An image pickup device mounted in said camera housing to receive Optical input from the endoscope and creating electrical signals based on the optical input;

A camera signal unit mounted in said camera housing and electrically connected to said image pickup for receiving the electrical signals from the image pickup device and providing a signal suitable for driving a display monitor;

At least one function control button mounted to said camera housing and electrically connected to said camera signal unit.

A transmitter for converting the display monitor signal into a frequency for transmission through space to a remote receiver;

An antenna connected to the transmitter for transmission of the frequency; and

A battery to supply power to the endoscope video camera.

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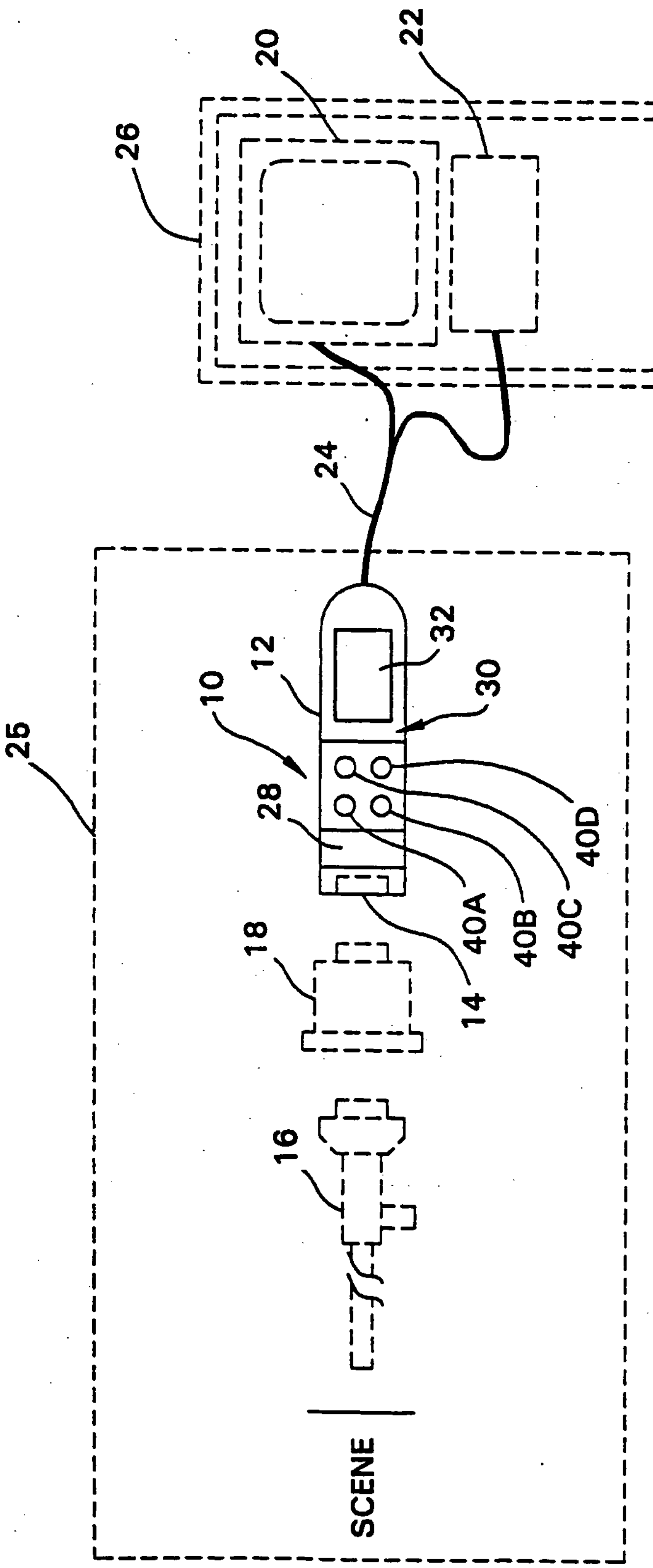

FIG. 1

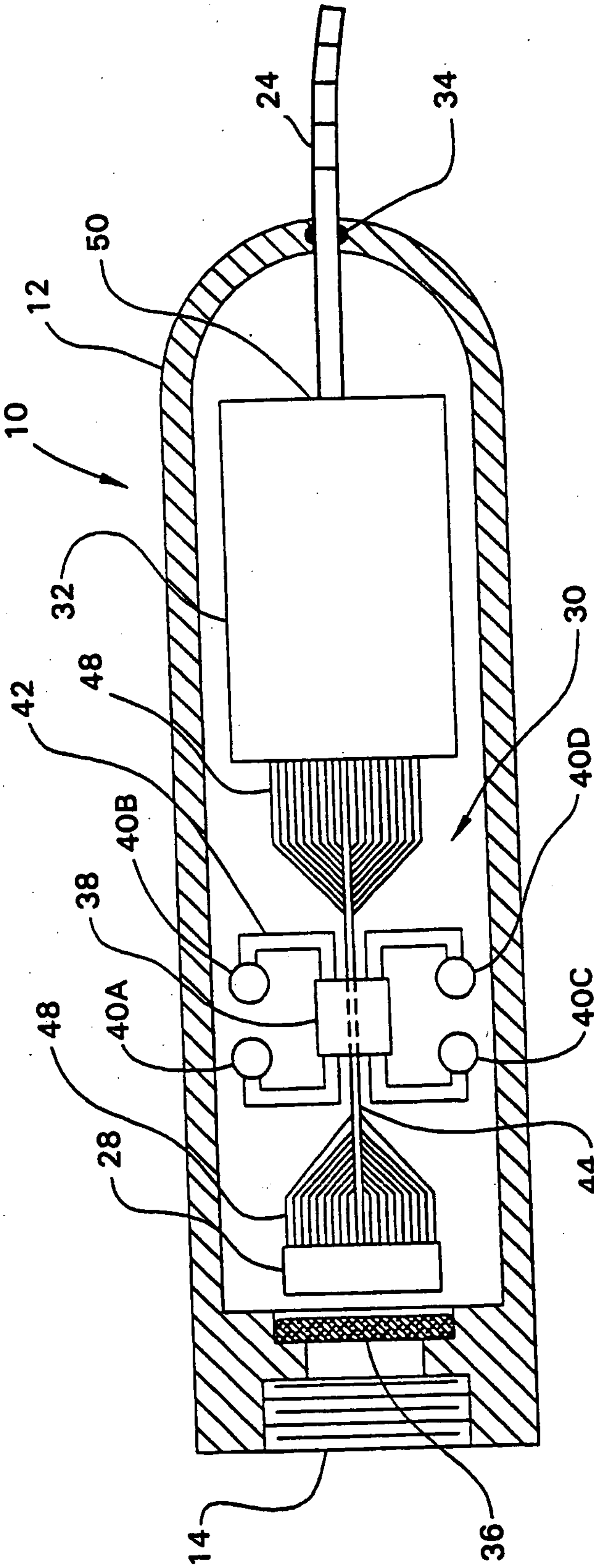

FIG. 2

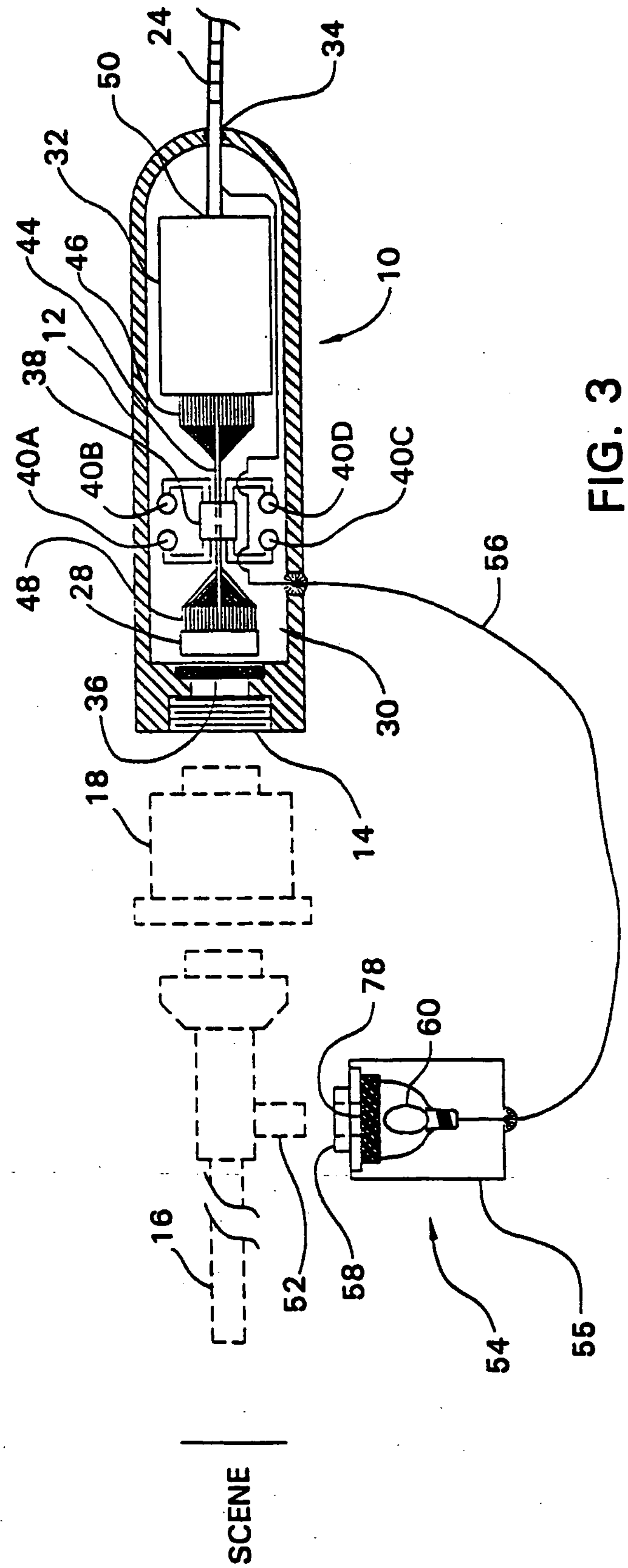
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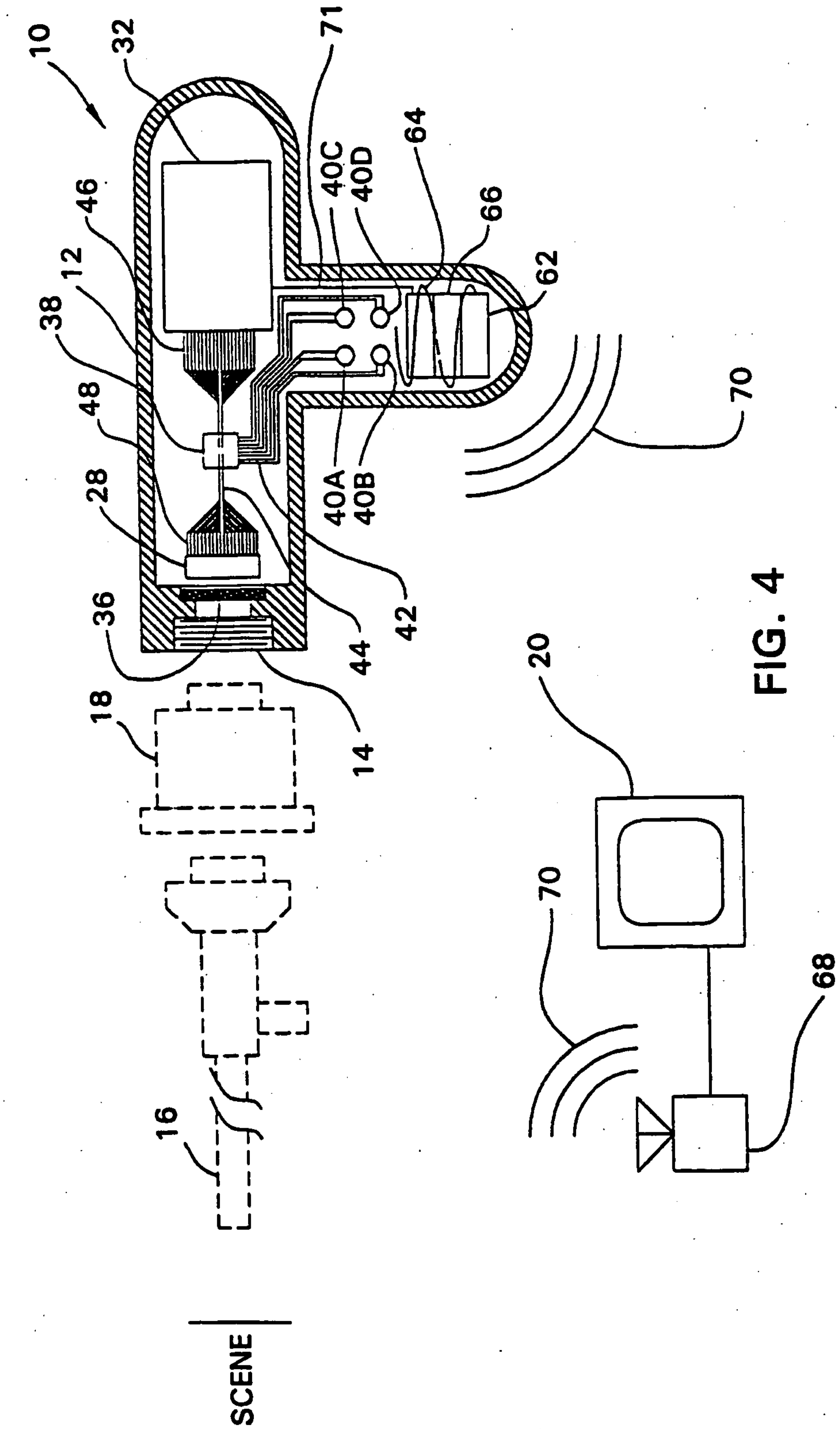
FIG. 3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SCENE

FIG. 4

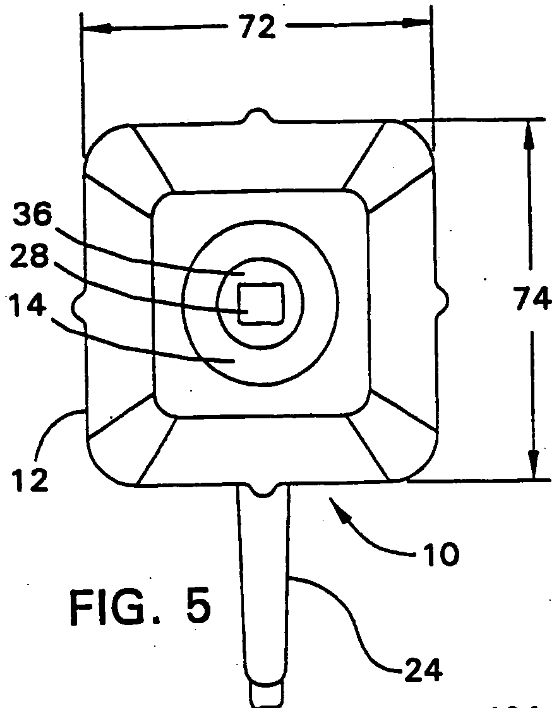

FIG. 5

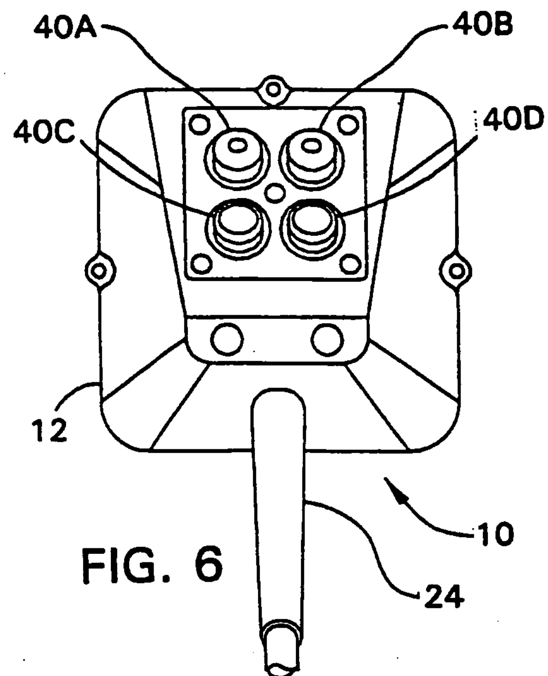

FIG. 6

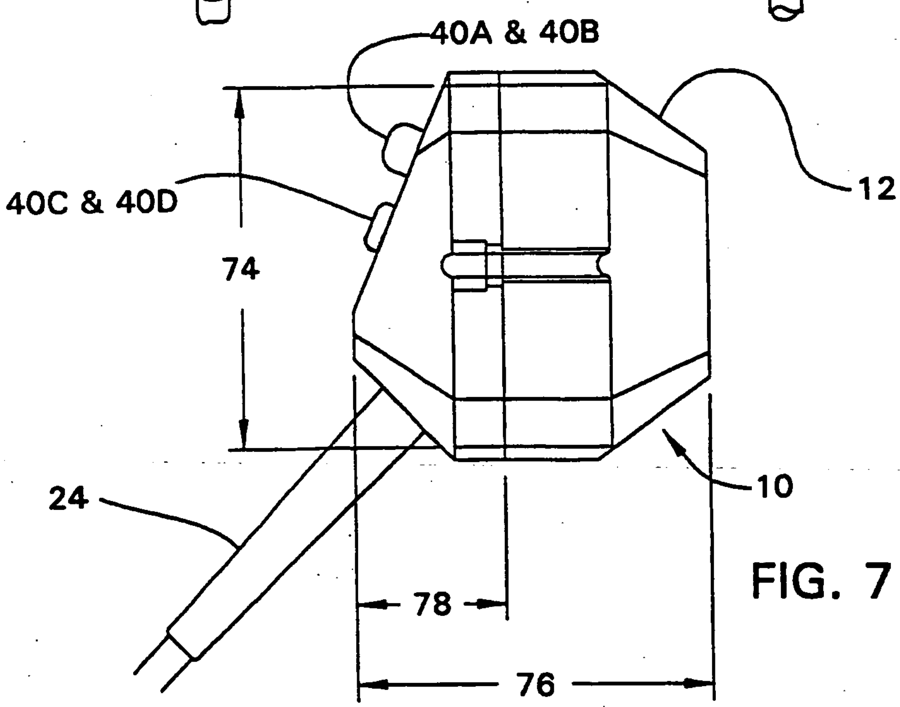

FIG. 7

INTERNATIONAL SEARCH REPORT

Inter   nal Application No
PCT/US 00/01761

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B1/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 868 878 A (WELCH ALLYN INC.) 7 October 1998 (1998-10-07) column 4, line 54 -column 16, line 35	1-6,8,9, 12,14-16
X	FR 2 718 916 A (MALANÇON & AL) 20 October 1995 (1995-10-20) page 3, line 5 -page 4, line 20	1,13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 May 2000	19/05/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lemercier, D

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 00/01761

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 868878 A	07-10-1998	CA 2234141 A JP 11155815 A	04-10-1998 15-06-1999
FR 2718916 A	20-10-1995	NONE	